

**There are no normal peacetime
operations of greater importance than
the avoidance of heavy weather damage.**

(OPORD 201)



Overview

- * **Climatology**
 - * **Air Masses and Fronts**
 - * **Extratropical Cyclones**
 - * **Tropical Cyclones**
- * **Weather Equipment**
- * **Reporting Requirements**
- * **Products and Services**
- * **Ship Routing and Heavy Weather Avoidance**

OOD Responsibilities:

OPNAVINST 3120.32C (SORM)

- 1. Keep advised of the location and movement high wind and seas.**
- 2. Update the CO on any changes.**
- 3. Insure all personnel on watch are protected.**
- 4. Minimize the number of personnel on the weather decks.**
- 5. Ensure personnel on weather decks have and wear safety gear.**

OOD Responsibilities:

OPNAVINST 3120.32C (SORM)

6. Be alert to possible damage and take measures to minimize it.

7. Make sure lookouts report all personnel on weather decks.

8. When expecting heavy weather pass the word and have all departments report to the OOD when completed.

9. When heavy weather conditions are set, pass the word frequently.

Basic METOC Products

- **OPAREA Forecast**
- **Tropical Cyclone Warnings**
- **High Winds/Seas Warnings**
- **WEAX**
- **OTSR**

OPAREA Forecast

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D1502YUW RHMMFWC70113441424-UUUU--RDEP50U.
ZNY UUUUU
P121424Z DEC 97 ZPW 131759Z DEC 97
FM NAVFAC METOCEN PEARL HARBOR HL01B//
TO AIG NINE TWO NINE ONE
INFO CNO WASHINGTON DC//N511W3//
NAF BARBERS PT HI//77//
COMBATWINGSPAC BARBERS PT HI//77//
PATRON FOUR SEVEN
PATRON FOUR
PATRON SPEC PROJ UNIT TWO BARBERS PT HI//77//
COGARD AIRSTA BARBERS PT HI//77//
PACMIFRANTRC HAWAIIAN BARRING SANDS HI//7530/7531/7532/7533//
NAVFACMETOC DET BARBERS PT HI//011//
COMSUBPAC PEARL HARBOR HI//073/0511//
NAVFACMETOC PAC SAN DIEGO CA//05//
USS CROMWELLIN
USS CECOM
USS FLETCHER
USS HOPPER
USS SARGUARD
USS CV FIDUS
BT
UNCLAS//NO1144//
EPHW PHDC 121800
KSCINGENADMMHNAVFACMETOCEN//
SUBJ:24HR FCST FOR PEARL HARBOR AREA, HAWAIIAN OPAREA 5 AND
PACIFIC MISSILE RANGE FACILITY//
REF:NAFAC SPAC TDC/1A88//
1. HIGH PRESSURE TO THE NORTHWEST OF THE ISLANDS WILL DOMINATE
THE WEATHER TODAY, ALLOWING FOR DRY TRADES TODAY.
2. 24HR FCST COMMENCING 120000W.
A. PEARL HARBOR AND OFFSHORE CONDITIONS (BARBERS PT EASTWARD
TO DIAMOND HEAD).
CLOUD COVER: PAIRLY CLDY.
PRECIP: NONE.
VIS (NM): UNRESTD.
WINDS (KT): NORTHEAST 10-15.
TEMP (DEG F): MAX: 80 MIN: 69 SST: 77-79.
COMBINED SEAS (FT): 2-4.
SWELL (FT): EAST-NORTHEAST 2-4.
NNNN
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- Available via
 - Homepage
 - AUTODIN
- Transmitted Once Daily



SIGNIFICANT TROPICAL WEATHER ADVISORY

- **issued daily at 0600Z**
- **lists all tropical disturbances with a closed circulation persisting more than 24 hrs**
- **disturbances referred to as suspect areas with a subjective rating of POOR, FAIR, OR GOOD for further**

Mobile Environmental Team, Yokosuka

ABPW10 PGTW 200600Z
SUBJ/SIGNIFICANT TROPICAL WEATHER ADVISORY FOR THE
WESTERN PACIFIC OCEAN/200600Z/210600Z APR 95//
REF/A/RMG/NAVPACMETOCCEN GQ/200151Z APR 95//
RMKS/1. WESTERN NORTH PACIFIC AREA (180 TO MALAY
PENINSULA):

A. TROPICAL CYCLONE SUMMARY: NONE.

B. TROPICAL DISTURBANCE SUMMARY:

(1) THE AREA OF CONVECTION PREVIOUSLY
MENTIONED NEAR 08.6N4 156.02E2 IS NOW THE SUBJECT OF
A TROPICAL CYCLONE FORMATION ALERT AND IS LOCATED
NEAR 10.0N1 153.0E9. SEE REF A TROPICAL CYCLONE
FORMATION ALERT (WTPN21 PGTW 210200Z) FOR FURTHER
DETAILS. SYNOPTIC DATA INDICATES A LOW-LEVEL
CIRCULATION BENEATH UPPER-LEVEL DIVERGENCE. MAXIMUM
SUSTAINED WINDS ARE ESTIMATED AT 20 TO 25 KNOTS.
MINIMUM SEA LEVEL PRESSURE IS ESTIMATED TO BE 1006
MB. THE POTENTIAL FOR SIGNIFICANT TROPICAL CYCLONE
DEVELOPMENT IS GOOD.

(2) NO OTHER SUSPECT AREAS.

2. WESTERN SOUTH PACIFIC AREA (180 TO 135E):

A. TROPICAL CYCLONE SUMMARY: NO SUSPECT
AREAS.//



TROPICAL CYCLONE FORMATION ALERT

- **issued when formation of a tropical cyclone is likely within 24 hrs**

- **valid for 24 hrs, but does not expire**

Mobile Environmental Team, Yokosuka

WTPN21 PGTW 221200

SUBJ/TROPICAL CYCLONE FORMATION ALERT 221153Z
SEP 94 //

RMKS/1. FORMATION OF A SIGNIFICANT TROPICAL CYCLONE IS POSSIBLE WITHIN 120 NM EITHER SIDE OF A LINE FROM 11.3N5 161.9E7 TO 16.3N0 154.8E8 WITHIN THE NEXT 06 TO 24 HOURS.

AVAILABLE DATA DOES NOT JUSTIFY ISSUANCE OF NUMBERED TROPICAL CYCLONE WARNINGS AT THIS TIME. WINDS IN THE AREA ARE ESTIMATED TO BE 015 TO 020 KNOTS. METSAT IMAGERY AT 220930Z INDICATES A CIRCULATION CENTER IS LOCATED NEAR 11.8N0 161.1E9. THE SYSTEM IS MOVING NORTHWESTWARD AT 15 KNOTS.

2. REMARKS: SATELLITE IMAGERY INDICATES THE CIRCULATION CENTER MENTIONED ABOVE IS IN A BROAD AREA OF CONVECTION WHERE ENVIRONMENTAL CONDITIONS ARE FAVORABLE FOR FUTURE DEVELOPMENT. THE POTENTIAL FOR SIGNIFICANT TROPICAL CYCLONE DEVELOPMENT IS GOOD.

3. THIS ALERT VALID UNTIL 231200Z8. //



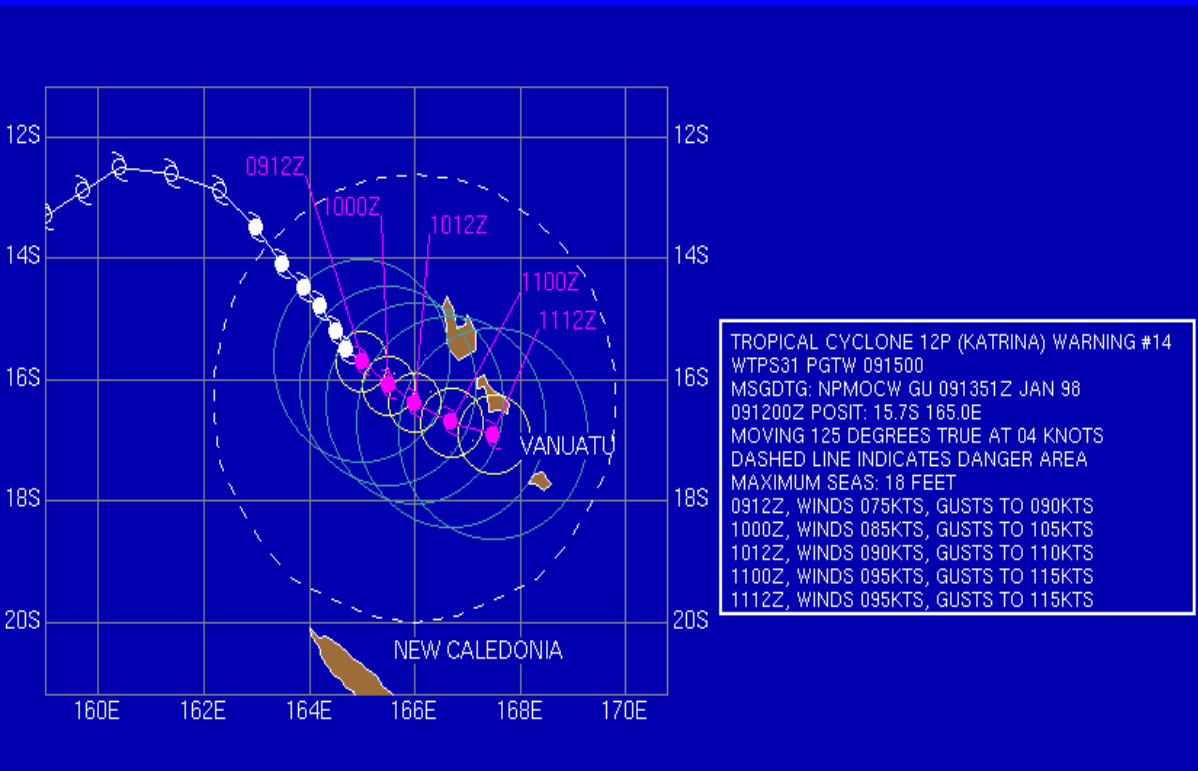
TROPICAL CYCLONE WARNING

- issued every 6 hours
- includes a 72 hour forecast
- valid at synoptic times (00Z, 06Z, 12Z, and 18Z)

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WTPN31 PGTW 120300
SUBJ/TROPICAL CYCLONE WARNING//
RMKS/1. TYPHOON VERNON (26W) WARNING NR 10
02 ACTIVE TROPICAL CYCLONES IN NORTHWESTPAC
MAX SUSTAINED WINDS BASED ON ONE-MINUTE AVERAGE
---
WARNING POSITION:
120000Z3 --- 26.0N8 146.0E1
MOVEMENT PAST SIX HOURS - 320 DEGREES AT 12 KTS
POSITION ACCURATE TO WITHIN 30 NM
POSITION BASED ON EYE LOCATED BY SATELLITE
PRESENT WIND DISTRIBUTION:
MAX SUSTAINED WINDS - 090 KT, GUSTS TO 110 KT
RADIUS OF 050 KT WINDS - 060 NM
RADIUS OF 035 KT WINDS - 180 NM NE SEMICIRCLE
150 NM ELSEWHERE
REPEAT POSITION: 26.0N8 146.0E1
---
FORECASTS:
12 HRS, VALID AT:
121200Z6 --- 28.0N1 144.0E8
MAX SUSTAINED WINDS - 090 KT, GUSTS 110 KT
RADIUS OF 050 KT WINDS - 060 NM
RADIUS OF 035 KT WINDS - 180 NM NE SEMICIRCLE
150 NM ELSEWHERE
VECTOR TO 24 HR POSIT: 320/ 12 KTS
---
REMARKS:
120600Z9 POSITION 27.5N4 134.0E8
TYPHOON VERNON CONTINUES MOVING NORTHWEST TOWARDS
HONSHU. ESTIMATED CENTRAL PRESSURE IS 940MB.
LATEST TRENDS INDICATE CONTINUED SLOW
STRENGTHENING. NEXT WARNINGS AT 121500Z9 (DTG
121353Z5), 122100Z6 (DTG 121953Z1), 130300Z7
(DTG 130153Z3), AND 130900Z3 (DTG
130753Z9) . //
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Tropical Cyclone Warnings

- Available via
 - Homepage
 - AUTODIN
 - JMCIS
- Issued Every 6 Hours (Every 12 Hours in Southern Hemisphere)
- Valid for 00Z, 06Z, 12Z, and 18Z.
- Forecast Position, Intensity, Wind Radii out to 72 hours





PROGNOSTIC REASONING

- **issued twice a day
for 00Z and 12Z**
- **discusses current
situation,
intensity, wind
radii, forecast
reasoning, and
alternate scenarios**

WDPN32 PGW 270900
SUBJ/ PROGNOSTIC REASONING FOR TROPICAL STORM VAL
(20W) //
RMKS/1. FOR METEOROLOGISTS.
2. PROGNOSTIC REASONING FOR 270600Z TO 290000Z SEP 92
A. ANIMATED SATELLITE IMAGERY INDICATES THAT
TROPICAL STORM VAL HAS RECURVED TO THE NORTHEAST AND
HAS ALMOST COMPLETELY TRANSITIONED INTO AN
EXTRATROPICAL CYCLONE. THE LOW LEVEL IS FULLY EXPOSED
AND ALL CONVECTION IS TO THE NORTH OF THE SYSTEM
CENTER. CURRENT INTENSITY IS BASED ON A HERBERT-
POTTEAT ANALYSIS WITH A CURRENT INTENSITY (CI) OF 3.0
AND A FINAL T-NUMBER OF 2.5.
B. NO SIGNIFICANT CHANGE TO OUR TRACK FORECAST
PHILOSOPHY. NOW THAT VAL HAS MOVED INTO THE
WESTERLIES, IT IS EXPECTED TO ACCELERATE AND MOVE
RAPIDLY TO THE NORTHEAST UNDER THE INFLUENCE OF
STRONG SOUTHWESTERLY MIDLEVEL FLOW.
C. NO SIGNIFICANT CHANGE TO OUR INTENSITY FORECAST
PHILOSOPHY. VAL WILL SHORTLY TRANSITION INTO AN
EXTRATROPICAL CYCLONE AND STEADILY WEAKEN AS IT
ENCOUNTERS STRONG VERTICAL WIND SHEAR IN EXCESS OF 50
KNOTS. //

High Winds and Seas Warnings

- Available via
 - Homepage
 - AUTODIN
 - JMCIS
- Transmitted Twice Daily

Optimum Track Ship Routing (OTSR)

- An advisory service whose primary mission is safety.
- Secondary mission is to save time and/or fuel.
- Issues sortie recommendations.

OTSR

Recommendations

- Issued when wind and sea conditions are expected to exceed limits, or
- If conditions improve such that a change of course can result in significant savings.
- All OTSR divert recommendations require an acknowledgement and intentions response within 12 hours of receipt.

Logging and Reporting

Governing Directives

- **SOP**
- **OPORD**
- **OPTASK**
- **NAVMETOCCOMINST 3144.1D**
HOW TO RECORD and ENCODE
- **NAVMETOCCOMINST 3140.1K**
WHEN TO TRANSMIT

Instruments

Anemometer

Aneroid Barometer

Thermometer

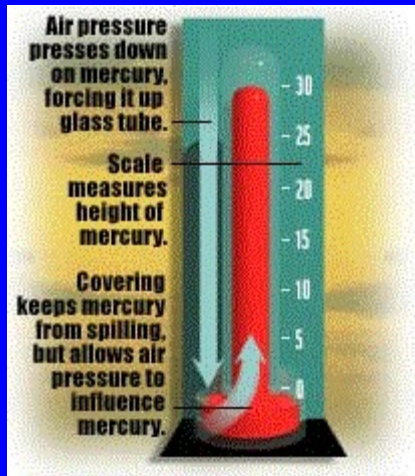
Psychrometer

Anemometer



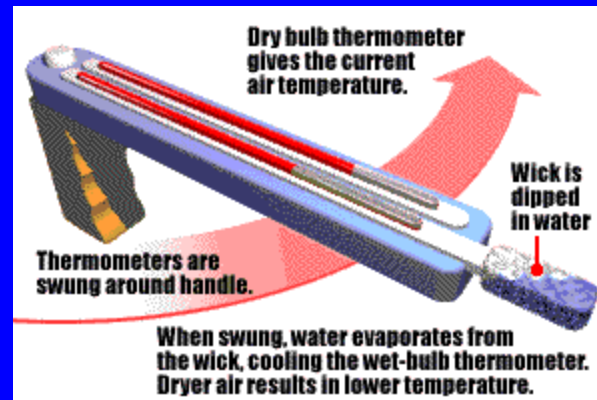
Measures Wind Speed And Direction

Aneroid Barometer



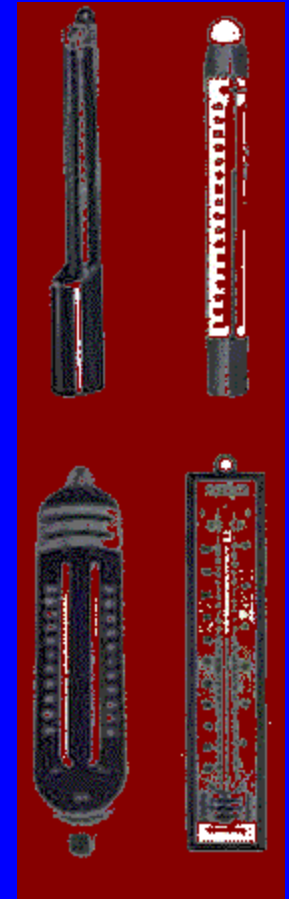
Measures Pressure

Psychrometer



Measures Wet And Dry Bulb For Dewpoint

Thermometer



Transmitting Weather Observations

PER NAVMETOCCOMINST 3140.1K
SEA HEIGHT (FT) SURFACE WND SPEED (KTS)
PRECEDENCE

FREQUENCY (From 00Z)

0-12
PRIORITY

0-33

Every 6 hours

12 and Greater
IMMEDIATE

34 and Greater

Every 3 hours

DURING MINIMIZE:

- 1. WIND >34 KTS**
- 2. SEAS \geq 12 FT**
- 3. MODERATE OR HEAVY PRECIP.**
- 4. PRESSURE CHANGE OF \geq 3 MB**
- 5. VISBY <1 NM**
- 6. DICTATED BY CURRENT OPERATIONS**
- 7. VOLCANIC ASH**



Southwest Monsoon

- Heat lows form over Asia (summer...)
- High Pressure in Southern Hemisphere
- Temp/Pressure Differential
 - Hot, Low Pressure over land
 - Relatively cooler, higher pressures over water
- Brings strong southwesterly winds, convection (South China Sea)

Fronts

Cold

Warm

Occluded

Cold Front

- Winds

- Southwest Shifting to Northwest after Frontal Passage

- Weather

- Thunderstorms
- Rainshowers

- Visibility

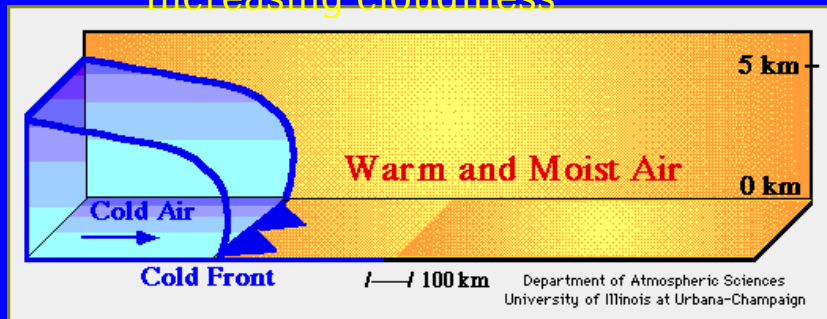
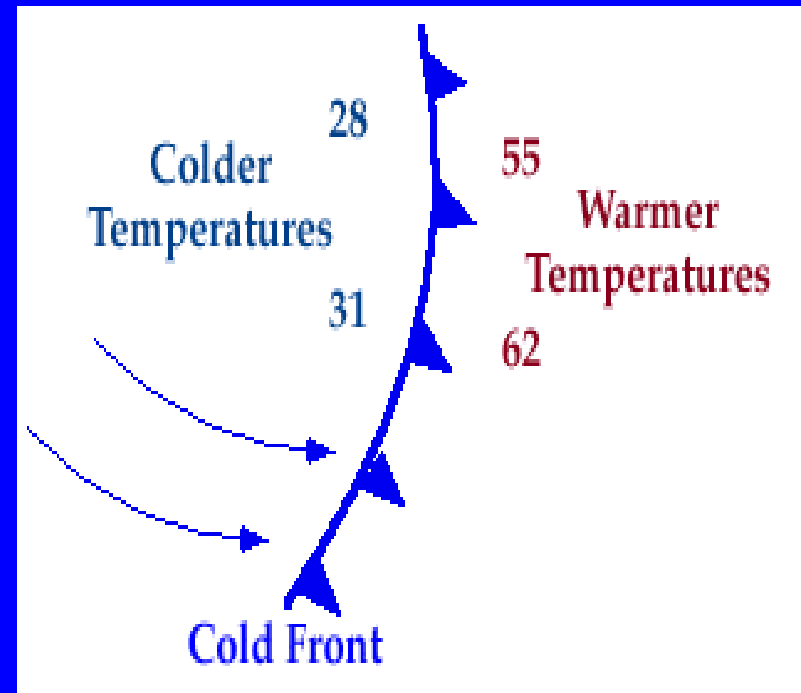
- Decreasing

- Temperature

- Cooler and drier after frontal passage

- Rules of Thumb

- Southwest Wind
- Cumulus (puffy) clouds
- Falling Pressures
- Increasing cloudiness



Towering Cumulus

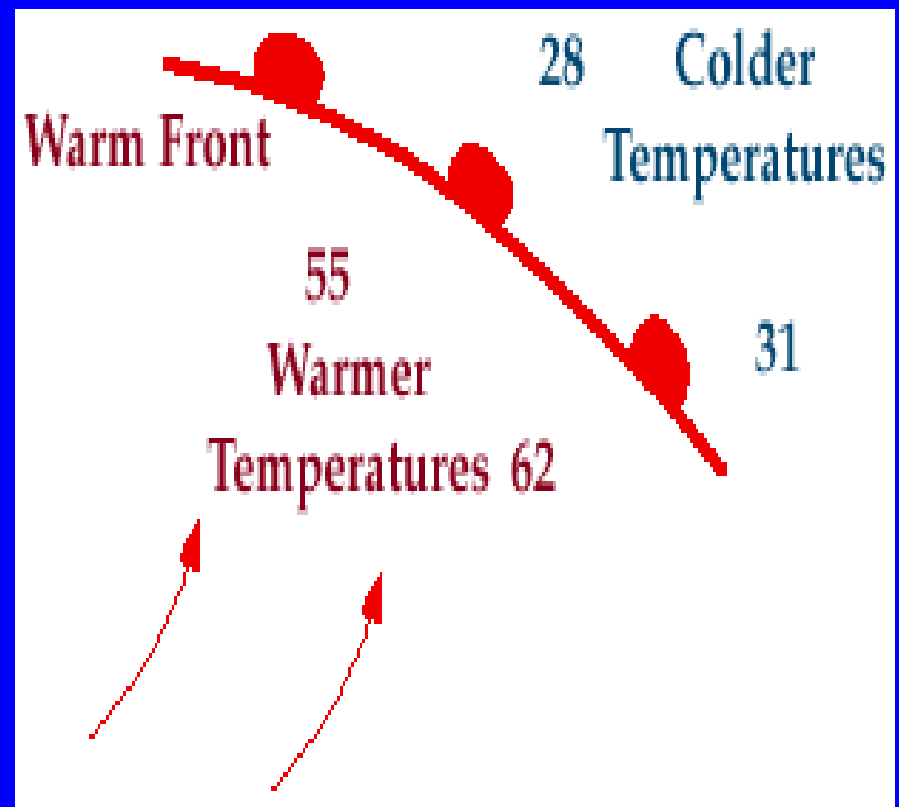


Cumulonimbus



Warm Front

- Winds
 - Southeast Shifting to Southwest
- Weather
 - Rain, Drizzle, Possible Thunderstorm
 - Fog (when ground is cool)
- Visibility
 - Decreasing
- Temperature
 - Warm and Moist After Frontal Passage
- Rules of Thumb
 - Southeast Wind
 - Stratus (flat) clouds
 - Falling Pressures
 - Increasing cloudiness, low ceilings



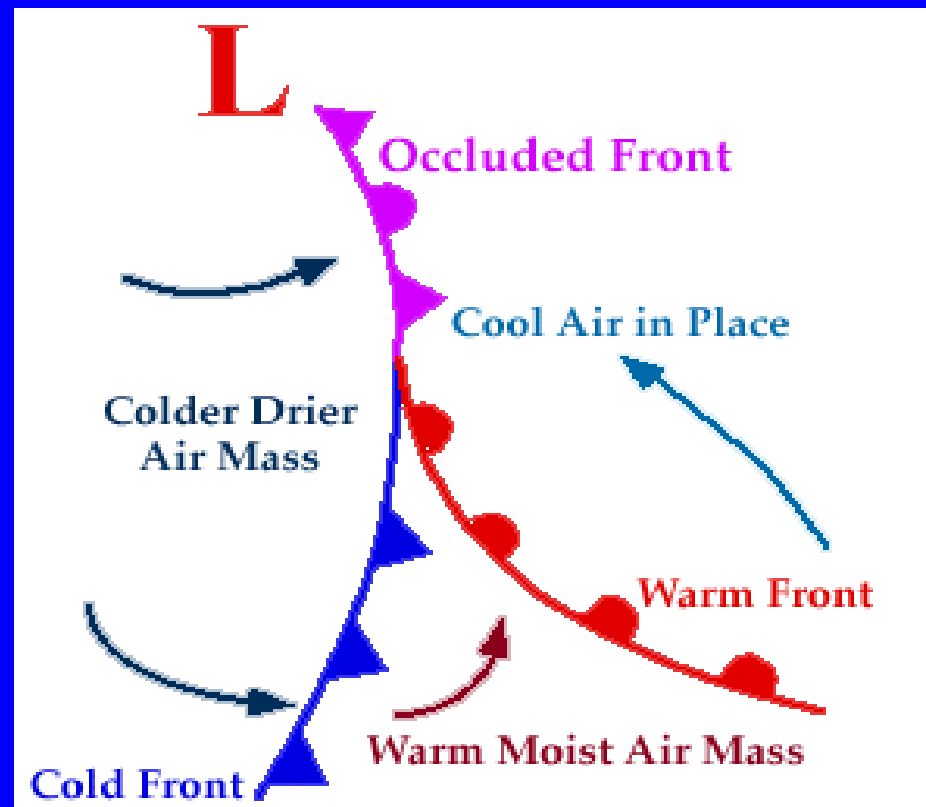
Stratus

**a Common Warm Frontal
Cloud**



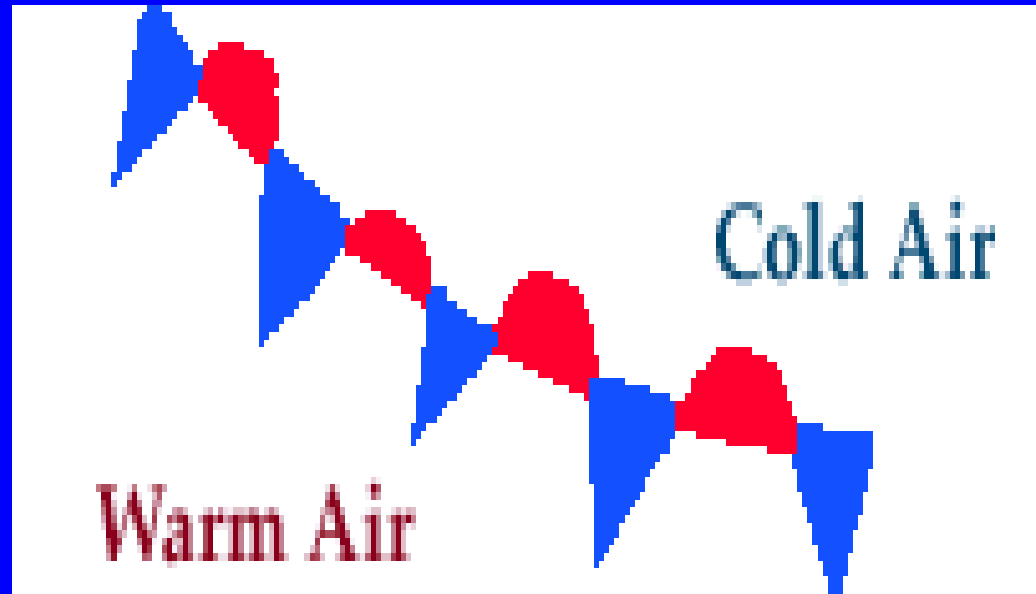
Occluded Front

- Winds
 - Varies, but veering (shifting clockwise)
- Weather- Combination of Warm and Cold Fronts
 - Rainshowers, Drizzle, Possible Thunderstorm
 - Fog (when ground is cool)
- Visibility
 - Clear to Very Poor
- Temperature
 - Change not Significant
- Rules of Thumb
 - Mixed bag of weather
 - Low Pressures



Stationary Front

- Winds
 - Easterly on cold air side, westerly on warm air side
- Weather
 - Thunderstorm on Cold Air Side
- Visibility
 - Potentially poor
- Temperature
 - Minor variations across front
- Rules of Thumb
 - Persistently poor weather
 - STATIONARY FRONTS CAN LAST FOR DAYS OR WEEKS!!!



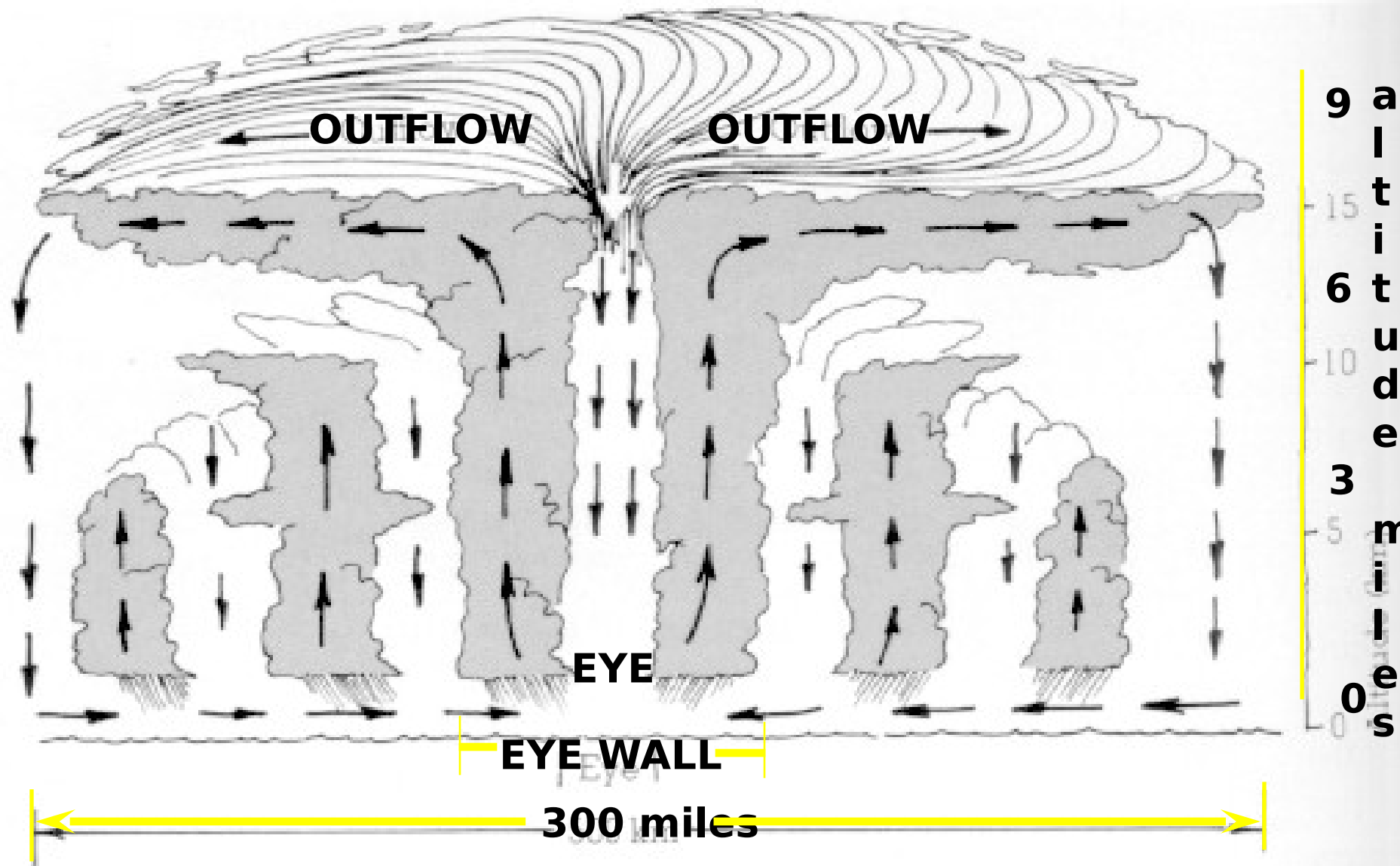
Tropical Cyclone Development

Five Conditions:

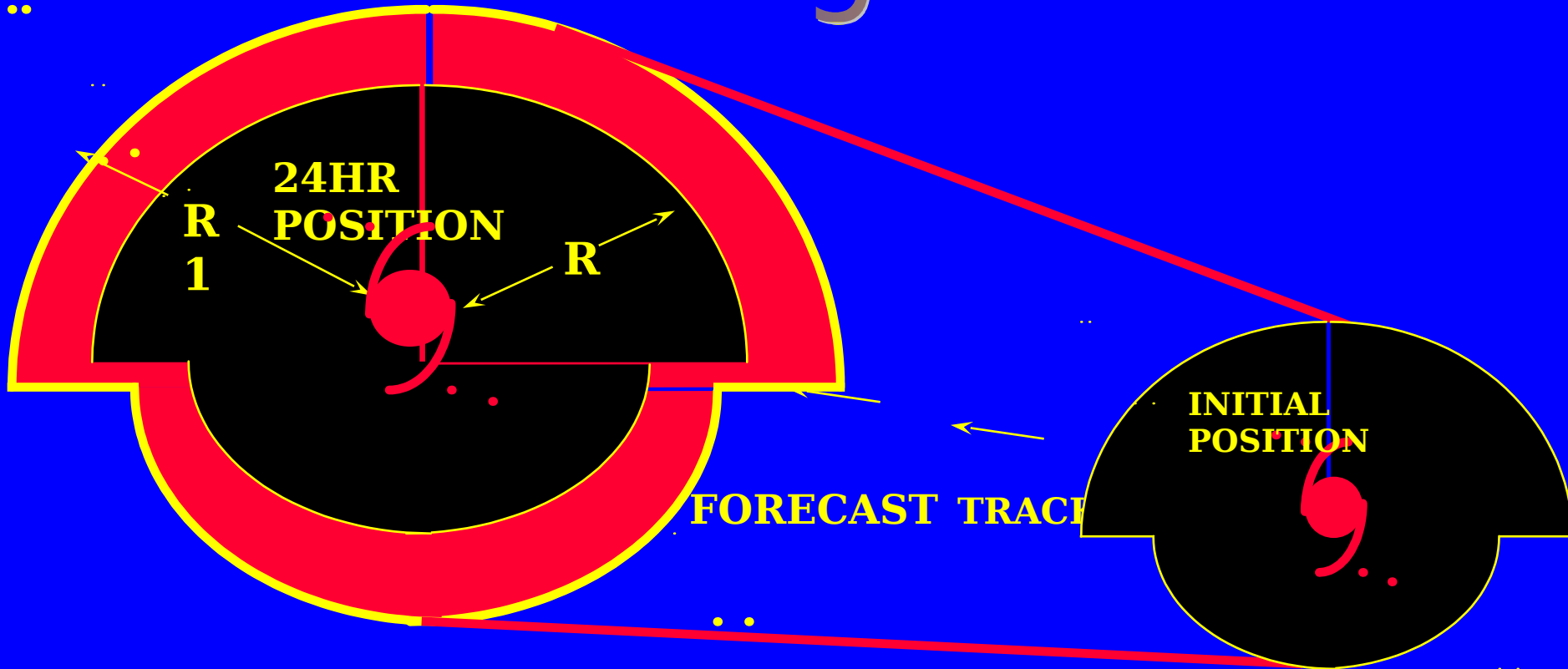
- Warm Sea Surface Temp (>79 Deg F)
- Pre-Existing Surface Disturbance
- Minimal Vertical Wind Shear
- Poleward of 5 Deg Latitude
- Divergence Aloft



Storm Structure



The Danger Area



AREA OF 35 KNOTS OR GREATER WINDS

120 NM RADIUS TO ACCOUNT FOR FORECAST INACCURACY



TYPHOON HAVENS

GUAM

APRA HARBOR - POOR

HONG KONG - POOR

JAPAN

SASEBO - GOOD

YOKOSUKA - GOOD

IWAKUNI - MARGINAL

OKINAWA - POOR

NUMAZU OPERA - POOR

KOREA

INCHON - POOR

PUSAN - POOR

CHINHAE - MARGINAL

TITANIC EVASION

TROPICAL CYCLONE WARNING SIGNS



- **HEAVY SWELLS WITH A LONG PERIOD (15-30SEC)**
 - can occur hundreds of miles ahead of storm
 - will arrive from general direction storm bears
- **PRESSURE DROPS 3.5MB (0.1 INS) IN 24 HRS**
 - large pressure changes in tropics are unusual
 - steadily falling pressure signals trouble
- **WINDS > 25 KNOTS OR ANY WESTERLY WIND**
 - NE trades usually blow at 10-20 knots
- **INCREASING CIRRUS LOWERING TO ALTOSTRATUS**
 - cirrus arrives about 24 hours ahead of storm
 - steady rain begins with altostratus



REQUIRED REPORTS

AT SEA

SYNOPTIC WEATHER OBSERVATIONS

- when within 300NM of a tropical cyclone or TCFA area, send via IMMEDIATE precedence every 3 hours

TYPHOON EVASION SITREPS

- sent when a tropical cyclone, or the 24-hour danger area, affects operations
- sent via IMMEDIATE precedence every 6 hours



REFERENCES

- **USCINCPACINST 3140.1W**
- **CINCPACFLT OPORD 201 ANNEX H**
- **NAVOCEANCOMINST 3140.1K**
- **NAVOCEANCOMINST 3144.1D**
- **TYPHOON HAVENS HANDBOOK FOR THE WESTERN PACIFIC AND INDIA OCEANS, NAVENVPREDRSCHFAC TP 5-76**
- **USFJ PL-355-1/COMFLEACTINST 3140.1S**
- **HEAVY WEATHER GUIDE/AMERICAN PRACTICAL NAVIGATOR VOL 1**
- **MARINERS WORLDWIDE CLIMATE GUIDE TO TROPICAL STORMS AT SEA, NAVAIR 50-1C-61**